

The Interaction of School Organization and Classroom Dynamics: Factors Impacting Student Achievement

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Abstract

Research was conducted to determine what impact school organization and classroom dynamics had on student achievement. Results from standardized benchmark tests found no significant differences in scores across all schools and content areas; yet, end of course standardized measures indicated that students in sites employing block scheduling performed significantly lower in all content areas than did their counterparts in traditional settings. Findings suggested that the significant differences in student scores might be due to a dramatic loss of instructional time that was consistently observed in block classes during the last 18 minutes of the instructional period. This loss of instructional time was characterized by a dramatic increase in student behavior problems and student time-off-task.

Recently, administrators in one Southeastern school district sought the authors' help in isolating the variables that might explain why their four high schools exhibited varying levels of academic achievement. Two of the high schools employed traditional scheduling, one employed block scheduling, and one used traditional scheduling for English I and Algebra I but used block scheduling for all other courses. A review of the scores from the state required End of Course (EOC) examinations in English I, Algebra I, U.S. History, and Biology I, indicated that the students in classrooms organized in the traditional manner consistently scored higher on the EOC examinations when compared to their counterparts in classrooms using block scheduling. The district leaders requested that research be completed to determine if these differences in achievement were the result of organizational structure or other factors in the learning environments.

The research design was based on the theory that an examination of classroom dynamics is the preferred method to fully understand how teachers best function in their role and how students best learn (Bracey 2009a; Pianta 2006; Schlechty 1976; Lortie 1975; Jackson 1968; Waller 1961). As Bracey (2009b) noted, educational research should focus on teacher and student interactions and how teachers structure the learning environment to encourage these interactions. Research which focuses on how an average student or average teacher functions on an isolated task fails to take into account the importance of understanding how teachers and students

interact in the learning environment and the impact that this interaction has on both the quality of instruction and the amount of learning that takes place.

Impact of School Organization

Findings related to the impact of school organization and academic performance have been inconsistent. Zepeda and Mayers (2006) noted that findings in the area of block scheduling have been inconsistent and sometimes flawed to the degree that little information has been provided that would allow practitioners to make data based decisions. This inconsistency could be due, in part, to the fact that some teachers are not effectively using instructional time. For example, Queen, Algozzine, and Eaddy (1997) reported that 30% of observed teachers were still relying on lecture while 20 to 30 minutes of instructional time was either wasted or used to complete homework.

Several researchers have investigated the relationship between organizational structure and student academic performance. When standardized test scores were used for comparison, researchers again reported mixed results. Knight, De Leon, and Smith (1999) and Gruber and Onwuegbuzie (2001) reported that students in traditional classrooms scored significantly higher than block students on standardized tests in both mathematics and language arts. Cobb, Abate, and Baker (1999) found that students in traditional classrooms scored significantly higher on standardized tests in mathematics while no differences were found in reading and writing. Conversely, Evans, Tokarczyk, Rice, and McCray (2002) reported higher AP scores for block schedule students; likewise, Fletcher (1997) and Khazzaka (1997) found that block scheduling positively affected achievement. However, Duel (1999) and Lare, Jablonski, and Salvaterra (2002) reported no significant difference when comparing standardized scores. In a study similar to the one being reported here, Lawrence and McPherson (2000), using average EOC examination scores in Algebra I, Biology I, English I, and U.S. History, found that students in traditional classrooms scored significantly higher than students in block classrooms.

Impact of Classroom Dynamics

To create supportive learning environments, one must first understand how teachers and students interact during both instructional and behavior management episodes (Pianta 2006). A major instructional strategy used by teachers to engage students in the learning environment is the use of questioning. The literature has long supported the fact that teachers spend much class time asking questions (Brualdi 1998; Stevens 1912). Classic research by Gallagher and Aschner (1963) developed a hierarchy of academic questions that included the following: low level thinking (cognitive memory and convergent) and high level thinking (divergent and evaluative). However, there are inconsistent findings regarding the relationship between level of cognitive questions and student achievement. For example, Wilen (1991) and Arends (1994) reported no difference between high level and low level questioning as they impact student achievement. Conversely, Rosenshine (1971) found a positive relationship existing between the level of cognitive questions and student achievement. Additionally, Wilen (1991) also found that the asking of high level questions encouraged students to use critical thinking when explaining answers and supporting responses; however, the researcher also reported that teachers asked primarily low level cognitive questions.

Higher student achievement has been associated with active student learning when paired with indirect teaching methods (Barron and Darling-Hammond 2008, Richards 2005); however, it has been reported that many high school teachers may not have been provided the training needed to successfully implement indirect strategies (Jenkins, Queen, and Algozzine 2001). Significantly, in a study of 2,100 students, it was reported that the use of indirect teaching methods that encourage communication, critical thinking, and problem solving were discovered to have a positive relationship to student achievement regardless of the students' previous achievement, race, or gender (Newman, Marks, & Gamoran 1995).

Non-instructional interactions can also have a powerful impact on the dynamics of the learning environment. Rimm-Kaufman, La Paro, Downer, and Pianta (2005) found that a low number of behavior management interactions was most consistently related to high classroom quality. Teachers who created an optimal learning environment minimized the time that students were off-task while encouraging a climate in which teachers and students were working on specific learning tasks. As, Waxman and Huang (1997) reported, on-task interactions between teachers and their students characterized effective classroom climates.

Wiseman and Hunt (2014) reported that an increase in teacher management behaviors were found to be inversely correlated to teacher task behavior and student time-on-task behavior. Furthermore, Clough, Smasal, and Clough (1994) concluded that student behavior issues attracted the attention of all members in the classroom away from instructional tasks and made it more difficult to refocus students' attention back on task. Therefore, the opportunity to dedicate time to learning was created by reducing behavior management problems, thus increasing the amount of time students were on task.

Methods

This study was designed to isolate factors that may have accounted for previously identified differences in student scores on EOC tests. Two research questions were used to examine possible differences across the four schools, four content areas, and two organizational patterns:

Research Question 1: What is the relationship between school organizational pattern and EOC examinations?

Research Question 2: What is the relationship between classroom dynamics and student performance on EOC examinations?

To answer the first research question, benchmark and EOC scores were analyzed using quantitative methods to determine if differences existed between block and traditional classroom settings. To answer the second research question, researchers collected observational data in the selected classrooms; these data were then analyzed using quantitative methods. In order to better understand the dynamics of the individual classrooms, researchers collected data in the following areas: classroom instructional interactions between teachers and their students, classroom management interactions between teachers and their students, the amount of student time-on-

task, the types and number of direct and indirect instructional methodologies employed by teachers, and the number and level of teacher and student questions.

Participants

The four high schools studied made up the total population of high schools in a Southeastern school district serving both rural and small town populations; although much of the population came from low socio-economic families, some students came from working class and upper middle class homes. School 1, which is located in a small town, had an enrollment of 553 students; 414 of whom received free or reduced price lunch. School 2, which is located in a rural area, had an enrollment of 412 students; 257 of whom received free or reduced price lunch. School 3, which is located in the largest town (population approximately 10,000) in the district, served 953 students; 610 of whom received free or reduced price lunch. School 4, which is located in a more affluent area, served 786 students; 257 of whom received free or reduced price lunch. All four schools serve grades 9-12, but they do not all use the same organizational patterns. School 1 is the only high school in the district to use two organizational patterns simultaneously; all freshmen are enrolled in English I and Algebra I classes in a traditional year-long format while all other classes are taught on a block format. School 2 and School 4 both utilize a traditional six period schedule with classes lasting the entire academic year. School 3 utilizes block scheduling. Therefore, the traditional sites were School 1a (Algebra I and English I), School 2, and School 4; the block scheduling sites were School 1b (all classes other than freshmen Algebra I and English I) and School 3.

All teachers who taught English I, Algebra I, U.S. History, and Biology I classes were observed in one of their sections in each of the four high schools. Thus, the sample was composed of 41 Algebra I, English I, U.S. History, and Biology I teachers and the 665 students who were assigned to them during the randomly chosen sections that were observed. Table 1 displays the distribution of teachers across content areas and schools.

Table 1
Distribution of teachers across content areas and schools

Schools	Content Areas			
	Algebra I	Biology I	English I	U.S. History
1a	2		2	
1b		2		2
2	3	3	2	1
3	4	4	2	2
4	4	2	3	3

Procedures and Operational Definitions

Data were collected using observational methods. All observations were unannounced and scheduled randomly to ensure that teachers were seen during the selected sections. All teachers were observed three times for 30 minutes per visit; therefore, each teacher was observed in the

same class period for a total of 90 minutes. The teachers in the schools employing block formats taught in classes that lasted 90 minutes; for these teachers, one observation was made in each the first 30 minutes, the second 30 minutes, and the last 30 minutes. Teachers in schools employing traditional formats taught classes that ranged from 48 minutes to 55 minutes. Since observations lasted 30 minutes, it was impossible to observe these classes during the first, second, and third segments as was done in those schools employing 90 minute blocks. Observations in block classes were completed during the fall semester due to the fact that EOC examinations were given at the end of the semester, and schedules changed at mid-year. In the schools employing traditional scheduling, each teacher was observed once during the fall semester and twice during the spring semester since schedules lasted the entire year.

The researchers worked in pairs to collect data during each 30 minute observation. The first researcher collected data related to student and teacher interactions as well as student time-on-task behavior. The second researcher simultaneously collected data specifically related to instruction. All data collectors were faculty members who had been teaching and supervising field experiences in teacher education programs for a minimum of 5 years. Data collectors were trained in half-day workshops during which they carefully reviewed and discussed operational definitions and recording codes. Prior to actual data collection, the researchers took part in practice observations in public school classrooms where inter-rater reliability was established with agreement exceeding the 97% level.

The first observer recorded teacher and student interactions that were either related to instruction or classroom management. The operational definitions of these behaviors were adapted from the work of Schlechty (1976). Teacher instructional behavior, as defined in this study, includes teachers giving out information, asking questions, and answering student questions; these interactions were recorded as *teacher task behavior*. Behavior management interactions include asking students to change their behavior (*teacher normative behavior*), punishing or threatening to punish students to coerce them into changing their behavior (*teacher coercive behavior*), rewarding students for exhibiting desired (*teacher remunerative behavior*), and ignoring students who are in violation of stated behavior expectations or rules (*teacher retreating behavior*). Additionally, student instructional interactions included students answering content-related questions asked by the teacher or fellow students, asking content-related questions to the teacher or fellow students, and making appropriate content-related comments within the flow of the lesson; these interactions were recorded as *student task behavior*. Student behaviors related to classroom management included students complying with a teacher's request to change their behavior (*student conformity*) and overtly disregarding stated school and teacher conduct rules and requests (*student rebellion*).

Time-on-task scans were conducted every 10 minutes to record the number of students in the classroom who were not attending to or involved in an appropriate learning experience. Students were considered on task unless it was obvious to the observer that the students were not appropriately involved. Time-on-task was recorded as a fraction designating the number of students who were off-task over the total number of students in the classroom when the scan was completed.

The second member recorded the types and duration of both instructional groupings and instructional methods employed. The instructional grouping designations were *whole class*, *small groups*, and *individualized*. The types of methodology were categorized as either direct instruction or indirect instruction and then subcategorized under those headings as found in Hunt, Wiseman, and Touzel (2009). Direct instruction included drill, lecture, modeling, brainstorming, teacher-led discussion, and use of videos; indirect instruction included learning centers, cooperative learning, inquiry, independent projects, and laboratory techniques (i.e., students working together in groups and manipulating items or equipment with teacher guidance). Although seatwork could be considered as a direct strategy, it was analyzed separately. The second observer also recorded questions as either high level or low level using the classification system developed by Gallagher and Aschner (1963).

Results

Data were analyzed to answer the research questions. The answers to these research questions provided researchers with information related to factors impacting EOC scores in high schools under study.

School Organization's Impact on Student test Performance

On average, students in the block classrooms scored 52.02 points on the four benchmark tests while students in traditional classrooms scored 53.52 points. The biggest difference in benchmark scores between block and traditional classrooms occurs in English. The two-way analysis of variance (ANOVA), showed no significant interaction between school organization (block vs. traditional) and course with respect to mean benchmark scores ($F = 0.54$; $p\text{-value} = 0.6582$). Moreover, using the same analysis, there was no significant difference between block and traditional classrooms with respect to mean benchmark scores ($F = 0.20$; $p\text{-value} = 0.6558$).

Figure 1 displays an interaction plot comparing the effect of content area and organizational pattern on the mean EOC scores. From this plot, notice the overall consistent gap in the average EOC scores between traditional and block scheduling for all content areas. Using a two-way ANOVA, content area and organizational format do not significantly interact to affect mean EOC scores ($F = 0.31$; $p\text{-value} = 0.8207$). However, using the same model, a significant difference is found between traditional ($M = 76.34$) and block classrooms ($M = 71.15$) with respect to mean EOC scores ($F = 5.67$; $p\text{-value} = 0.0232$).

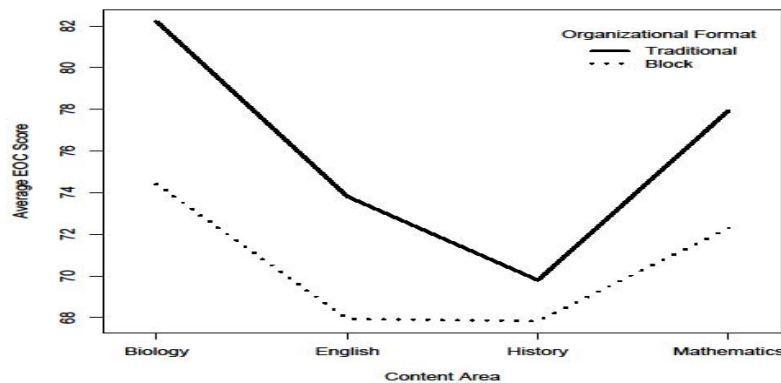


Figure 1

Interaction plot of average EOC test scores against organizational format for each content area.

Note, there was no significant difference between the scores of students in block and traditional classrooms at the beginning of the semester on the benchmark tests; however, at the end of the semester, the students in traditional classrooms achieved significantly higher scores on the EOC than the students in the block classrooms. Moreover, content area did not seem to impact the difference between either benchmark or EOC scores.

Classroom Dynamics' Impact on Student Test Performance

Based on Spearman's rank correlation coefficients between the different teacher/student interactions and EOC examination scores, no teacher or student interaction is significantly related to EOC scores. Moreover, when using multiple linear regression, no student interaction, teacher interaction, nor percentage of students on task were significantly useful in predicting the average EOC score ($F=0.81$; $p\text{-value} = 0.5834$). However, further analyses were helpful in answering Research Question 2.

How teachers interact with students

Teacher task behavior was by far the most prevalent teacher interaction (see Table 2). Using Hotelling's T^2 test, which is a multivariate test for equality of means for two populations, it is possible to test for a significant difference between block and traditional organizational formatting with respect to the different teacher interactions. However, due to low prevalence, teacher remunerative control and teacher coercion were not included in this analysis. The resulting analysis yielded a test statistic of $T^2 = 2.17$ with a $p\text{-value} = 0.5646$. Therefore, there is no significant difference between block and traditional organizational formatting with respect to the mean frequency of teacher task interaction, teacher normative behavior, or teacher retreating.

Table 2
Observed teacher task and management interactions

Teacher Interaction	Schedule	Min	25th Percentile	Median	Mean	75th Percentile	Max
Teacher Task	Block	178	260.5	334	336.12	400.5	498
	Traditional	121	254.5	312	332	391.5	610
Teacher Normative	Block	1	6.5	12	20.18	35.5	54
	Traditional	0	3.5	7	14.12	15	68
Teacher Retreatism	Block	0	1.5	11	17.94	25.5	72
	Traditional	0	0.5	3	10.64	17	58
Teacher Coercion	Block	0	0	2	1.53	3	6
	Traditional	0	0	0	0.92	2	4

Even though no significant difference was found between block and traditional classrooms in regard to teacher interactions, interesting phenomena were observed by looking at teacher retreating as a function of time. Figure 2 displays the change in the average frequency of teacher retreating as time increases for both block and traditional classrooms. In block classrooms, three total observations were made: one during the first third, one during the second third, and one during the final third of the period. Hence, the combined total accounts for the entire 90 minute period. In traditional classrooms, scans were made on three separate visits at roughly the same time of the period. Therefore, only the first thirty minutes of traditional classrooms can be examined. However, by modelling the series of observations with a time series model, forecasts of future observations can be made. Due to the short nature or small sample size of our series, Krishners and Borisov (2012) recommend using the exponential smoothing method to obtain forecasts. These forecasts are displayed in Figure 2 as the dashed line. In addition, 95% confidence limits for the forecasts of the average frequency of teacher retreating for the next hour on traditional scheduling at six minute intervals can be constructed. These limits give plausible values for average frequency of teacher retreating if the traditional classroom environment was observed for additional time. Again, due to the short nature of this series, great caution is taken in the interpretation of the intervals. These intervals will serve as an idea of what would most likely occur if the traditional classroom environment was continued for another 60 minutes. The resulting confidence limits are also provided and are displayed as dotted lines.

As seen in Figure 2, there is an overall increase in the average frequency of teacher retreating for both block and traditional classrooms. This increase is more consistent for traditional classrooms. This consistency or reduced variation is due to having measurements over a similar time period and averaging these repeated measurements. Also, notice that the range of values for the first 30 minutes in traditional classrooms is similar to the first 42 minutes in block classrooms. After the 42 minute mark in the block classrooms, there is more variation in the values. In addition, there is an increasing trend in both the observed average values for block classrooms and the forecasted values for the traditional classrooms as time increases. Also, it is interesting to observe the extreme value observed during the last six minutes of the block classroom. This suggests as time increases, the more likely teacher retreatism will increase.

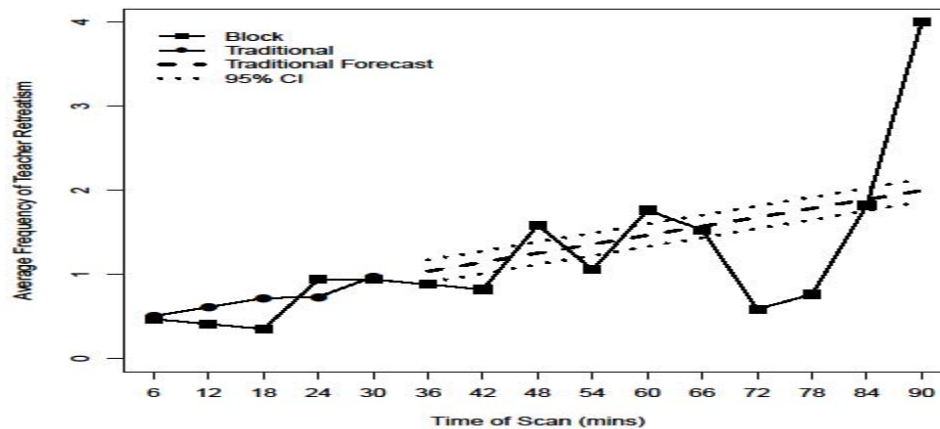


Figure 2

Time series plot of the average frequency of teacher retreatism behavior

How students interact with teachers

Using the multivariate Hotelling's T^2 , no significant differences between block and traditional formatting with respect to the mean frequency of student task interaction, student conformity behavior, and student rebellion behavior were found ($T^2 = 2.28$; $p\text{-value} = 0.5548$). Due to the large amount of variability observed within both types of classroom formats as compared to between both types of classroom formats, this difference was not found to be significant.

Looking at student rebellion as a function of time in Figure 3, a pattern similar to teacher retreating emerges. The average frequency of student rebellion behavior over time for both block and traditional classrooms along with the forecasted average values with 95% confidence limits from exponential smoothing is displayed. For both block and traditional classrooms, there is an overall increase in the average frequency of student rebellion. The values found for the first thirty minutes in traditional classrooms were consistent with the first 36 minutes found in block classrooms. From this figure, it is interesting to notice that what occurred in block classrooms is consistent with what is forecasted for the traditional classrooms in regards to student rebellion. That is, the longer students are in class, the frequency of student rebellion is more likely to increase.

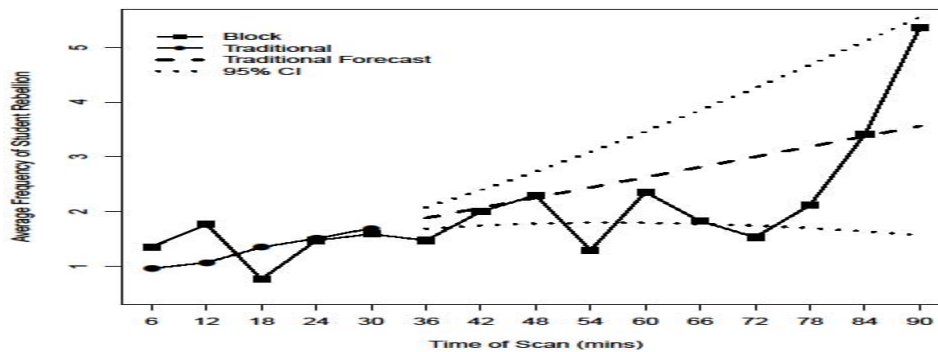


Figure 3

Time series plot of average frequency of student rebellion behavior

Teachers' use of instructional methodology

Nine different instructional methodologies were observed: six were direct strategies, two were indirect strategies, and one was seatwork. The teachers in this study predominantly used direct instruction. Using a two sample t-test, no significant difference was found between block and traditional formatting with respect to the average time spent in seatwork ($t = 0.275$; $p\text{-value} = 0.7846$). However, the average time spent in seatwork changes over time. Figure 4 displays the change in the average amount of time spent in seatwork as time increases for both block and traditional classrooms. Overall, there is an increasing trend for traditional classrooms. For block classrooms, there is a general increasing trend until the 72 minute mark. After the 72 minute mark, there is a general decrease in the average amount of time spent in seatwork. Also, the values for the first 30 minutes of traditional classrooms are roughly consistent with second third of the block. Based on these results, it seems that there is little difference between the average amounts of time spent doing seatwork in block classrooms than what would be likely found in traditional classrooms.

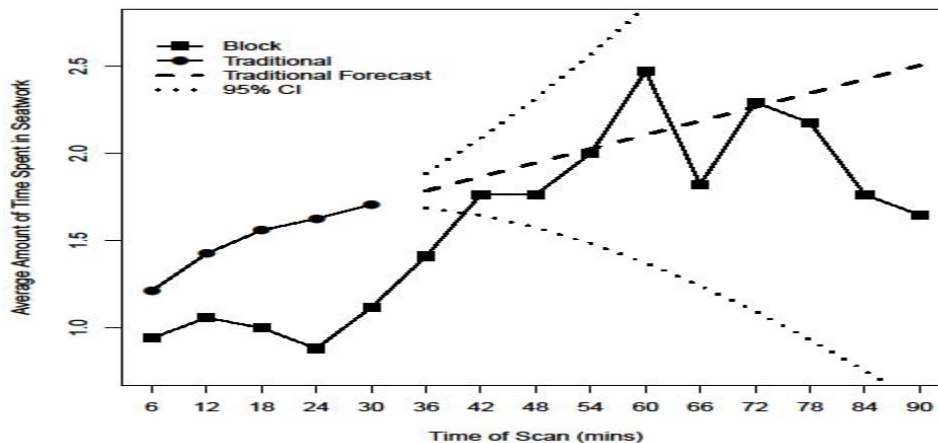


Figure 4

Time series plot of average time spent in seatwork

Levels of questioning

Teachers in block classrooms asked their students an average of 68.59 questions; the teachers in traditional classrooms asked their students an average of 80.04 questions. Using a two sample t-test, no significant difference was found between block and traditional classrooms with respect to the mean frequency of teacher questions asked ($t = -0.87$; $p\text{-value} = 0.3904$). Furthermore, students in block classrooms asked 19.12 questions on average and students in traditional classrooms asked 22.92 questions on average during the combined observations. No significant difference was found between block and traditional classrooms in regard to student questioning ($t = -0.85$; $p\text{-value} = 0.4021$).

Student on-task behavior

Using a two sample t-test, no significant difference was found between block and traditional with respect to the average percentage of students on task ($t = 1.324$; $p\text{-value} = 0.1947$). Figure 5 displays the change in the average percentage of students on task as time increases for both block and traditional classrooms. In block classrooms, an overall decreasing trend in the number of students on task can be seen; this is especially true in the last third of the block period. It should be noted that the range of values for the first thirty minutes in traditional classrooms is similar to the range found in the first 36 minutes of block classrooms. Also, notice that the forecasted values for traditional classrooms is similar for the most part to the actual values that were observed in block classrooms. An examination of Figure 5 illustrates that student time-on-task was negatively affected by time in the block classrooms as were teacher retreating and student rebellion. The same adverse effect is also seen in the forecasted values and confidence limits for traditional scheduling.

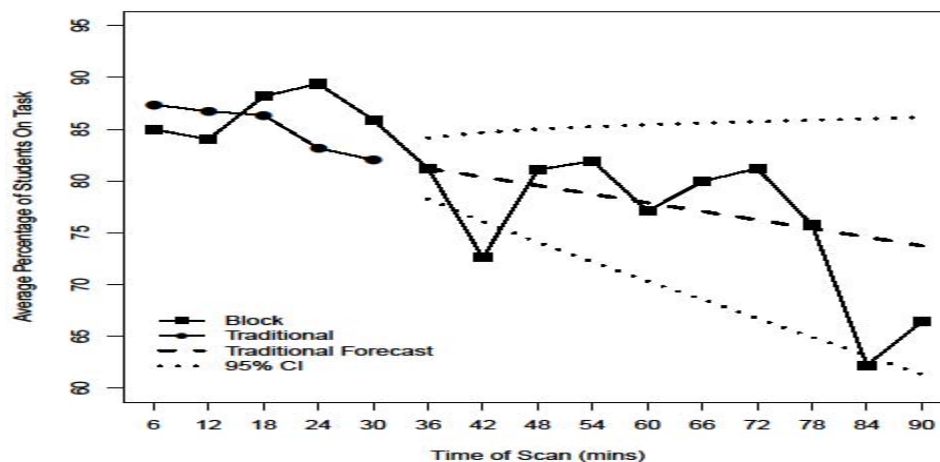


Figure 5
Time series plot of average on-task percentage

Discussion

The purpose of this inquiry was to determine factors that impacted tests scores in specific high school settings, not to make statements about the learning environments of all block classrooms

as compared to all traditionally organized classrooms. An analysis of the data indicated that it was not simply the organizational pattern that impacted performance; it was the use of instructional time within the structure that seems to account for the significant differences in the test scores.

As with all observational data collection, some limitations existed; for example, the research team would have preferred to observe classrooms for the entire class period. However, logistically this was impossible due to time constraints. For example, all block classes had to be observed in a single semester due to the fact that students would be with other teachers in the second semester, and all classes had to be observed in a single year by the four observers who were trained with high inter-rater reliability. Additionally, the data were collected across a representative sampling of the first, middle, and end of all block classes. The researchers feel confident that adequate data sets were collected on all teachers which provide ample evidence of the type of interaction taking place in each learning environment and the relationship between this interaction and student achievement.

An analysis of the test scores indicated that students in block classrooms scored significantly lower on the EOC examinations than those students in traditional classrooms. This finding supports the research of Lawrence and McPherson (2000) who reported that the EOC scores in Algebra I, Biology I, English I, and U. S. History were higher for those students in traditional classrooms versus those students in block classrooms. Furthermore, these findings support those of Knight, De Leon and Smith (1999) as well as the findings of Gruber and Onwuegbuzie (2001); however, they do not support the findings of Fletcher (1997), Khazzaka (1997), and Evans, Tokarczyk, Rice, and McCray (2002) who found that block scheduling positively affects student achievement, as well as the findings of Lare, Jablonski, and Salvaterra (2002) who found that achievement was not impacted by changing from a traditional format to a block scheduling format.

This significant difference between student EOC scores in block and traditional classrooms prompted researchers to conduct further analyses to determine if the students were significantly different in ability when the classes began. At the beginning of the school year, standardized benchmark examinations were administered in each of the courses where students took EOC examinations. An analysis of benchmark scores indicated that no significant difference was found between the students in traditional and block settings; further, this lack of significant difference was consistent across all content areas. Therefore, it was determined that no significant difference existed between block and traditional students when instruction began, and this was true across all content areas.

When teaching methodology was examined, it was determined that teachers in block and traditional classrooms did not vary significantly in how they delivered instruction. The levels of teacher questioning and student questioning were also essentially the same in both traditional and block classrooms. Thus, the researchers concluded that the way teachers and students interacted instructionally had little or no impact on the differences in scores in block versus traditional classes.

The amounts of student rebellion (Figure 2), teacher retreating (Figure 1), and student time-off-task (Figure 4) were all time related; each increased in block classrooms during the last 18 minutes of the 90 minute class period. Therefore, around the 72 minute mark, students in block classes started misbehaving (student rebellion), teachers started ignoring misbehavior (retreating), and students stopped doing academic tasks (student time-on-task). It should be noted that losing an average of 18 minutes a day would be equal to losing an average of one instructional day each five-day week. This finding is supported by the research of Queen, Algozzine, and Eaddy (1997) and illustrates the negative impact that student rebellion, teacher retreating, and loss of time-on-task has on the dynamics of learning environments (Wiseman and Hunt 2014; Rimm-Kaufman, La Paro, Downer and Pianta 2005; Waxman and Huang 1997; Clough, Smasal, and Clough 1994).

Based on these findings, the researchers believe that the significant differences in EOC scores seem to be due to a consistent loss of instructional time during the last 18 minutes of the longer class periods in block classrooms. This loss of instructional time is evident in the significant increase in student behavior problems and student time-off-task. In order to prevent this loss of instructional time, teachers need continuing in-service training and support to improve instructional procedures that are designed specifically for longer class periods. Moreover, building administrators need to clearly articulate the expectation that faculty will implement the skills and strategies focused on during the in-service training. Follow-up observations and feedback based on these expectations should be continuous to ensure proper implementation. Based on these findings, longer class periods associated with block formats may lead to such a large loss of instructional time that significant drops in student scores on standardized tests will occur if careful preparations for instruction are not implemented.

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